CHEMICAL HAZARD SUMMARY

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Man-Made Mineral Fibres

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SCOPE OF THE DOCUMENT

This document focuses on the main hazards of man-made mineral fibres (MMMF) for production workers. Details of first aid and workplace exposure controls are also described. In operations other than production, exposure to MMMF is combined with exposure to other substances. No data relevant to MMMF exposure alone exist for non-production processes.

CONTENTS

I. MAIN CONCERN 1

II. OCCUPATIONAL EXPOSURE 1

III. REMOVAL FROM THE BODY 1

IV. EFFECTS OF SHORT-TERM OVEREXPOSURE IN HUMANS 2

V. EFFECTS OF LONG-TERM OVEREXPOSURE IN HUMANS 2

VI. TOXICITY DATA IN ANIMALS AND LABORATORY TESTS 3

VII. EXPOSURE LIMITS 3

VIII. FIRST AID 4

IX. EXPOSURE CONTROL 4

X. STORAGE AND HANDLING 5

XI. SPILL AND LEAK PROCEDURES 5

XII. REFERENCES 6

I. MAIN CONCERN

The main concern about man-made mineral fibres is that long-term exposure to high concentrations might cause lung cancer[1].

II. OCCUPATIONAL EXPOSURE

The term "man-made mineral fibres" or "MMMF" describes a family of man-made, glass-like, fibrous products. These fibres are non-crystalline (as opposed for example to asbestos which has crystalline fibres). In general, crystalline fibres are considered harmful while non-crystalline fibres are not. Non-crystalline fibres are also called "amorphous." Man-made mineral fibres are made from molten glass (for fibreglass), molten rock (for rock wool), molten slag (for slag wool), or clay (for ceramic fibres). All these materials are made up of chemicals known as silicates. The term "man-made vitreous fibres" or "MMVF" is often used in place of MMMF. It refers specifically to the glass-like (vitreous) state of the fibres.

MMMF are used in thermal and noise insulation, textiles, reinforcement material in plastics, and high-efficiency filters for air, water or beverages[2]. However, this document focuses on the hazards presented by MMMF in producing the fibres.

MMMF enter the body by breathing in airborne fibres. Swallowing MMMF contributes a small amount to the overall exposure. Skin and eye contact cause slight health problems but do not increase the number of fibres entering the body.

It is important to note that the number of MMMF which reach the lungs depends on the size of the fibres. Above certain dimensions, the fibres are filtered out in the nose and the throat[2].

General information on routes of exposure is available in the CCOHS document "How Workplace Chemicals Enter the Body"[3].

III. REMOVAL FROM THE BODY

Fibres which are trapped in the nose and throat or swallowed are rapidly removed from the body. Fibres small enough to reach the lungs are removed slowly by the defence mechanisms of the body. Not all fibres will be removed from the lungs at the same rate. The rate of removal depends on the kinds of fibres. For example, ceramic fibres are cleared more slowly than mineral wool fibres. Removal also depends on the fibre size. Long (between 10-20 micrometers in length) and thin (less than 3.5 micrometers in diameter) fibres stay in the lungs longer than shorter, thicker ones[2]. Long and thin fibres are dissolved more rapidly than short or thick ones. The fibres which are not removed can stay in the lungs for long periods of time[4,5].

IV. EFFECTS OF SHORT-TERM OVEREXPOSURE IN HUMANS

Inhalation
The abrasive action of MMMF can irritate the nose and throat[2].

Eyes
MMMF can irritate the surface of the eyes, although this has not been observed often in industry[6,7].

Skin
MMMF can irritate the skin[2].

V. EFFECTS OF LONG-TERM OVEREXPOSURE IN HUMANS

The potential health risks of long-term exposure to MMMF are of greater concern than short-term exposures.

Lungs
A recent review of the literature shows that there is no increase in chronic respiratory diseases in humans involved in the production of MMMF when compared with an unexposed population[8]. Mixed exposures occur in operations other than production and no data relevant to MMMF exposure alone exist for non-production processes.

Eyes
Repeated exposure to low levels of MMMF may cause inflammation of the surface of the eyes[6].

This effect is rarely reported as a workplace problem.

Skin
Exposure to MMMF can temporarily inflame the skin. After repeated exposure the skin can "harden" and become tolerant to further exposure[9]. It has also been shown that, especially in the case of fibreglass, fibres with a diameter less than 4.5 micrometers do not cause significant skin irritation[2].

Exposure to MMMF alone does not cause allergic reactions[10]. However, there are some indications that repeated exposure to MMMF can cause an increased skin sensitivity in certain susceptible people[2].

Carcinogenic Effects
Most of the studies on MMMF exposures and the development of lung cancers (including mesothelioma, a type of cancer exclusively linked with asbestos exposure) did not show an increased number of cancers when compared to an unexposed population[8]. One study of mineral wool production workers has reported a significant increase in lung cancer[11]. However, the authors of this study conclude that the evidence is too weak to state with confidence that

exposure to mineral wool causes lung cancer. A recent, limited epidemiological study has shown a slight increased incidence of lung cancers in one fiberglass manufacturing operation[1].

Two studies where workers were exposed for long periods of time have shown a significant increase in the number of cancers of the mouth, larynx and pharynx when compared to the general, unexposed population[12,13]. Because of the limited number of studies, the very small number of reported cases of cancer, and the confounding effects of alcohol and tobacco use it is impossible to be certain that exposure to MMMF will cause cancer of these organs[8].

VI. TOXICITY DATA IN ANIMALS AND LABORATORY TESTS

Chronic Respiratory Diseases
Most studies of animals breathing large concentrations of MMMF have not shown any increased incidence of respiratory diseases[14-17]. However, one study involving rats breathing ceramic fibres has shown that this type of fibre could cause lung tissue scarring (fibrosis)[18].

Large amounts of MMMF placed directly in the lung airways (bypassing the nose and throat) or injected into the cavities surrounding the lungs caused lung fibrosis. This effect has been associated with the dimensions of the fibres. Fibres which are more than 10 micrometers in length and less than 1 micrometer in diameter can cause more fibrosis than shorter, thicker ones[16].

Placing MMMF directly in the lung airways and injecting them into body cavities do not resemble the types of exposures relevant to humans. Moreover, chronic respiratory diseases have not been confirmed in human population studies. Therefore, it is reasonable to expect there is only a small risk of developing chronic respiratory diseases from exposure to low concentrations of MMMF.

Cancers of the Respiratory System
Studies of animals breathing large concentrations of MMMF have not shown any increased incidence of cancers of the respiratory system[16].

Injection of MMMF into the cavities surrounding the lungs caused a significant number of cancers known as mesothelioma[16,19,20]. These animal studies are not directly relevant to humans, since humans would not be exposed to fibres in this manner. Moreover, from human population studies there is only weak evidence of an increased number of cancers. Therefore, it is reasonable to expect that the risk of developing cancers of the respiratory system from workplace exposure to MMMF is low[1,8,21].

VII. EXPOSURE LIMITS

Many Canadian jurisdictions have exposure limits similar to those established by the American Conference of Governmental Industrial Hygienists (ACGIH). The

exposure limit(s) established by ACGIH for fibrous glass dust and mineral wool is a time-weighted average value of 10 milligrams per cubic metre (mg/m^3)[22].

Contact the appropriate authority in your jurisdiction for details of the specific regulations which apply. Refer to ACGIH documentation for information on the exposure limits.

VIII. FIRST AID

Inhalation
If symptoms are experienced, remove the source of contamination or move the victim to fresh air. Obtain medical advice.

Eye Contact
If irritation occurs, immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 10 minutes holding the eyelids open. If the irritation persists, obtain medical attention.

Skin Contact
If irritation occurs, wash gently with water and non-abrasive soap. If the irritation persists, obtain medical attention.

Ingestion
In case of ingestion have the victim rinse the mouth thoroughly with water. If symptoms are experienced, obtain medical advice.

General Comments
All first aid procedures should be periodically reviewed by a physician familiar with the material and its condition of use in the workplace.

IX. EXPOSURE CONTROL

Engineering Controls
Engineering controls to reduce exposures are preferred. Methods include local exhaust ventilation, process or personnel enclosure, control of process conditions, and process modification. Other control methods such as administrative controls or the use of personal protective equipment may also be required.

Specific ventilation designs to control exposure to man-made mineral fibres for some industrial processes are provided in the ACGIH's "Industrial Ventilation : a Manual of Recommended Practice"[23].

Respiratory Protection
If engineering controls and work practices are not effective in controlling expsoure to MMMF, then wear suitable, approved personal protective equipment. Have appropriate equipment available for use in emergenices such as spills.

If respiratory protection is required, institute a complete, continuing respiratory protection program including selection, fit testing, training, maintenance, inspection, cleaning and evaluation. Refer to the CSA Standard Z94.4-M1982, "Selection, Care and Use of Respirators"[24].

Respiratory Protection Guidelines
Jurisdictions which have specific regulations for man-made mineral fibres may also require specific types of respiratory protection. The requirements depend on the concentration of fibres present and range from single-use disposable respirators to supplied-air respirators.

Since there may be some variation in these requirements, obtain specific information from the appropriate government agency in each jurisdiction.

In all cases, only NIOSH (National Institute for Occupational Safety and Health) or MSHA (Mining Safety and Health Administration) approved respirators should be used.

Eye/Face Protection
Use safety glasses suitable for dust protection.

X. STORAGE AND HANDLING

Storage Conditions
Whenever possible, store MMMF in sealed containers or in enclosed areas.

Handling
MMMF should be handled so as to minimize the amount of airborne dust (e.g. use wet processes or enclosed handling systems). Use in minimal quantities in designated areas with adequate ventilation. Use suitable, labelled containers, keep closed when not in use and protect from damage.

XI. SPILL AND LEAK PROCEDURES

Precautions
Restrict access to the spill area until clean-up is completed. Ensure that the clean-up is conducted by trained personnel, wearing appropriate protective equipment.

Cleanup
Do not dry-sweep MMMF. Whenever possible, wet down with a water spray to minimize the amount of MMMF that becomes airborne.

Disposal
Review federal, provincial and local government requirements prior to disposal. Disposal by secure landfill may be acceptable.

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Note: Additional references on this subject are available from CCOHS upon request.

PLEASE NOTE

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This summary was prepared at the Canadian Centre for Occupational Health and Safety (CCOHS) and is intended primarily as a source of information for persons who work with or may be occupationally exposed to this material. The information selected for inclusion is believed to be reliable and generally relevant to occupational health. Other information may be available which bears on particular work situations. The scientific data in many areas are limited and may allow a variety of interpretations. Additional information, corrections, comments and questions are welcome, and should be addressed to the Inquiries Service, CCOHS, 250 Main Street East, Hamilton, Ontario, L8N 1H6, (416) 572-2981; toll free 1-800-263-8276.

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